THE IHS PRIMARY CARE PROVIDER

August 1995 Volume 20, Number 8

Diabetes and Impaired Glucose Tolerance in Three American Indian Populations Aged 45-74 Years: The Strong Heart Study*

Elisa T. Lee, PhD, Center for Epidemiological Research (CER), University of Oklahoma Health Sciences Center (UOK), Oklahoma City, Oklahoma; Barbara V. Howard, PhD, the Medlantic Research Institute (MRI), Washington DC; Peter J. Savage, MD, the National Heart, Lung and Blood Institute (NHLB), the National Institutes of Health (NIH), Bethesda, Maryland; Linda D. Cowan, PhD, the Department of Biostatistics and Epidemiology, UOK Health Sciences Center; Richard R. Fabsitz, MA, NHLB, NIH; Arvo J. Oopik, MD, (deceased February 24, 1994) the Aberdeen Area Indian Health Service and Fitzsimmons Army Medical Center, Aurora, Colorado; Jeunliang Yeh, PhD, CER, UOK; Oscar Go, PhD, CER, UOK; David C. Robbins, MD, MRI; and Thomas K. Welty, MD, Aberdeen Area Indian Health Service, Rapid City, South Dakota.

Objective. *To estimate prevalence rates of diabetes and impaired glucose tolerance (IGT) in three American Indian populations, using standardized diagnostic criteria, and to assess the association of diabetes with the following selected possible risk factors: age, obesity, family history of diabetes, and amount of Indian ancestry.*

Research design and methods. *This cross-sectional study involved enrolled members, men and women aged 45-74 years, of 13 American Indian tribes or communities in Arizona, Oklahoma, and South and North Dakota. Eligible participants were invited to the clinic for a personal interview and a physical examination. Diabetes and IGT status were defined by the World Health Organization criteria and were based on fasting plasma glucose and oral glucose tolerance test results. Data on age, family history of diabetes. and amount of Indian ancestry were obtained from the personal interview, and measures of obesity included body mass index, percentage body fat, and waist-to-hip ratio.*

Results. *A total of 4,549 eligible participants were examined, and diabetes status was determined for 4,304 (1,446 in Arizona, 1,449 in Oklahoma, and 1,409 in the Dakotas). In all three centers, diabetes was more prevalent in women than in men. Arizona had the highest age-adjusted rates of diabetes: 65% in men and 72% in women. Diabetes rates in Oklahoma (38% in men and 42% in women) and South and North Dakota (33% in men and 40% in women), although considerably lower than in Arizona, were several times higher than those reported for the U.S. population. Rates of IGT among the three populations (14-17%) were similar to those in the U.S. population. Diabetes rates were positively associated with age, level of obesity, amount of Indian ancestry, and parental diabetes status.*

Conclusions. *Diabetes is found in epidemic proportions in Native American populations. Prevention programs and periodic screening should be implemented among American Indians. Standards of care and intervention have been developed by the Indian Health Service for individuals in whom diabetes is diagnosed. These programs should be expanded to include those with IGT to improve glycemic control or to reduce the risk of development of diabetes as well as to reduce the risk of diabetic complications.*

In This Issue...

* Reprinted, with permission of the American Diabetes Association. *Diabetes Care.* May 1995;18(5):599-610

In the U.S., approximately 1.5 million American Indians, Eskimos, and Aleuts reside on reservations or live among the general population. Diabetes was rarely diagnosed among the American Indians until the 1930s. However, in the last 60 years, it has become more common in most American Indian tribes/communities.[1,2] In most tribes, diabetes has become a major cause of morbidity and mortality and the prevalence of diabetes has been steadily rising.[2-7] The type of diabetes suffered by this group is believed to be almost exclusively non-insulin-dependent diabetes mellitus (NIDDM).[8]

Information on the prevalence of diabetes among American Indians is far from complete. It is also difficult to compare prevalence rates of diabetes among American Indians obtained in different studies. Different definitions of being Indian, non-uniform diagnostic criteria for diabetes, varying methodologies used to estimate the population at risk, and various sampling procedures contribute to the variation in the reported rates of diabetes.

The Strong Heart Study,[9] a three-center study funded by the National Heart, Lung, and Blood Institute, was initiated in 1988 to estimate cardiovascular disease (CVD) mortality and morbidity rates using standardized methodology and to compare CVD risk factors among American Indians living in three geographic areas: central Arizona, southwestern Oklahoma, and North and South Dakota. Because of the high prevalence of diabetes expected among American Indians and because diabetes is a recognized risk factor for CVD, standard glucose tolerance tests were administered to ascertain diabetic status. To our knowledge, the Strong Heart Study is the first study of CVD and its risk factors, including diabetes, in American Indians using a standardized protocol in several geographic areas. It provides an opportunity to obtain data on the prevalence of diabetes in three major Indian communities. This study reports the prevalence rates of diabetes, impaired glucose tolerance (IGT), and normal glucose tolerance (NGT) in the Strong Heart Study communities and their association with the following selected possible risk factors of diabetes: age, family history of diabetes, amount of Indian ancestry, and levels of obesity. We recognized that obesity may have been modified in many diabetic patients and thus, etiological interpretations of association would be inappropriate based solely on these cross-sectional data. However, association with family history of diabetes and degree of Indian blood may reflect some etiological role.

Research and Design Methods

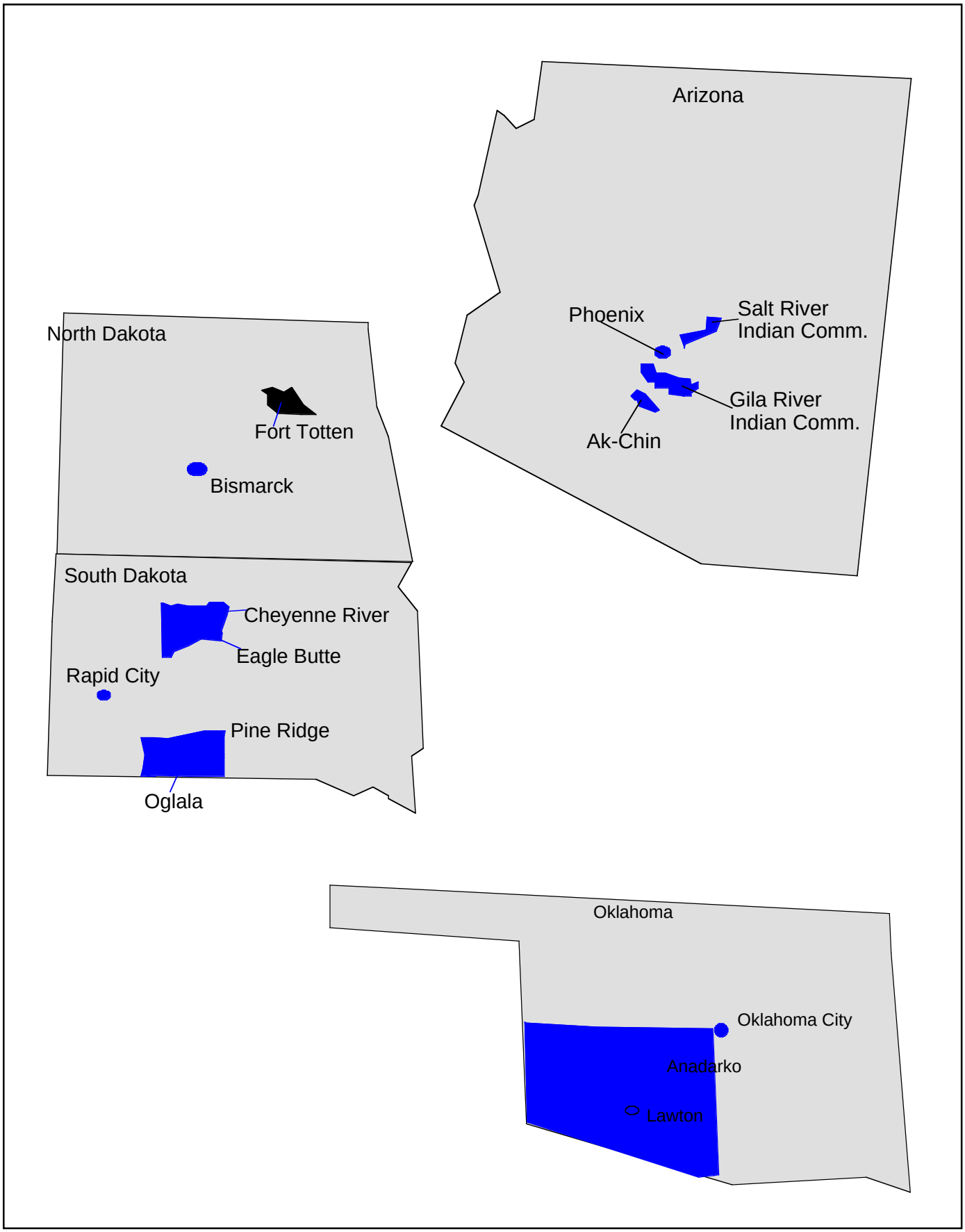
The primary objective of the Strong Heart Study was to estimate the prevalence of CVD and relate it to a number of potential risk factors by examining 1,500 men and women, aged 45-74 years, at each of the three centers. Participants were enrolled members of one of the 13 Indian tribes or communities living in the survey areas: the Pima/Maricopa/Papago of the Gila River, Salt River, and Ak-Chin Indian communities near Phoenix, AZ; the Apache, Caddo, Comanche, Delaware, Fort Sill Apache, Kiowa, and Wichita in southwestern Oklahoma; and the Oglala Sioux and Cheyenne River Sioux in South Dakota and the Devils Lake Sioux in the Fort Totten area of North Dakota. The map in Figure 1 identifies the study communities and their locations. In Arizona and Oklahoma, every eligible person was invited to participate. In North and South Dakota, a cluster sampling technique was used to obtain the 1,500 subjects needed: 900 from Pine Ridge, 400 from Eagle Butte area, and 200 from Fort Totten area. Participants were all volunteers.

The clinical examination consisted of a personal interview and a physical examination. Details of the examination have been described previously.[9] Briefly, the personal interview assessed demographic information, family health history, personal medical history, and lifestyle factors, such as smoking and alcohol consumption, and physical activity. The physical examination included anthropometric measurements; blood pressure measurements; examination of the heart, lungs, pulses, and vessels for bruits; a 12-lead electrocardiogram; fasting glucose and 2-hour glucose tolerance tests; fasting blood samples for measurements of lipids, lipoproteins, insulin, glycated hemoglobin, apolipoproteins, and fibrinogen; and a morning urine collection for measurements of albumin and creatinine.

Medical records were reviewed for previous glucose values, history of diabetes, and evidence of treatment for diabetes. A 2-hour oral glucose tolerance test (OGTT) was performed after ingestion of a 75g glucose load (Glutol, Paddock, Minneapolis, MN) on all participants except the following: (1) diabetic patients being treated with insulin, (2) diabetic patients who were taking oral hypoglycemic agents and whose medical records indicated at least two previous random glucose values $\oplus$ 250 mg/dl, and (3) participants with fasting glucose values $\oplus$ 225 mg/dl as determined by AccuChek II (Baxter Healthcare, Grand Prairie, TX). The participants were classified into five diabetes status groups based on their OGTT results and whether they were receiving hypoglycemia therapy. Criteria used for diabetes mellitus and IGT followed the World Health Organization (WHO) recommendations[10,11]:

- *Known diabetes.* If the participant (1) was receiving insulin treatment, (2) was receiving a hypoglycemic agent and had two prior measurements of elevated blood glucose ($\oplus$250 mg/dl) recorded, (3) was on renal dialysis or had kidney transplantation and a history of diabetes by questionnaire, or (4) had a fasting blood glucose value $\oplus$140 mg/dl or a 2-hour blood glucose value $\oplus$200 mg/dl and a history of diabetes by questionnaire.

Figure 1. Locations of Strong Heart Study communities



- *New diabetes*. If the participant had either a fasting blood glucose value ⊕140 mg/dl or a 2-hour blood glucose value ⊕200 mg/dl and no mention of a history of diabetes by questionnaire.
- *IGT*. If the participant had either a fasting blood glucose value <140 mg/dl or a 2-hour blood glucose value between 140 and 199 mg/dl.
- *NGT*. If the participant had fasting blood glucose and 2-hour blood glucose values <140 mg/dl and no history of diabetes by questionnaire.
- *Diabetic status undetermined*. (1) If the participant was on renal dialysis or had a kidney transplant without mention of diabetes in the medical history by questionnaire, (2) if the result of the OGTT was missing, or (3) if the participant refused an OGTT and, in some cases, if the fasting blood specimen was not sufficient to determine the diabetic status.

Indexes of obesity included body mass index (BMI) and percentage body fat, and fat distribution was measured by waist-to-hip ratio (WHR). BMI was calculated as weight in kilograms divided by the square of height in meters. Overweight was defined as a BMI of 27.83 to 31.09 for men and 27.3 to 32.29 for women. Obesity was defined as a BMI ⊕31.1 for men and ⊕32.3 for women. These criteria were approximately the 85th and 95th percentiles for men and women aged 20-29 from The National Health and Nutrition Examination and Survey II (NHANES II).[12] Of the study sample, these cutoff points corresponded to the 28th and 59th percentiles for women and the 39th and 64th percentiles for men. In comparing diabetes rates, subjects were also divided into two groups according to percentage body fat and WHR. Percentage body fat was estimated by bioelectrical impedance using a RJL impedance meter (model B14101, RJL Equipment, Detroit, Ml) and an equation based on total body water. The lean body mass was computed by multiplying the total body water by 0.732 (personal communication, M. Singer, RJL). Obesity was defined for men as having >34% body fat and for women >45% body fat. Waist girth was measured at the level of the umbilicus with the participant supine. The hip girth was measured at the level of maximal protrusion of the gluteal muscles. WHRs >0.98 for men and >0.96 for women were used as cutoff points. These values were approximately the 65th percentiles of the percentage body fat and WHR distributions of the study sample.

Statistical analysis. Statistical methods used include the direct method for standardizing prevalence rates[13] for age using 1980 U.S. census data, χ^2 test for comparing rates, analysis of variance technique, and Student's *t* tests for comparing continuous variables among different diabetic status groups and the three study centers.

Results

A total of 4,549 eligible participants were examined: 1,500 in Arizona, 1,522 in South and North Dakota, and 1,527 in Oklahoma. These numbers represent a participation rate of 71% in Arizona, 53% in South and North Dakota, and 62% in Oklahoma.[14] To determine how representative the participants were, a random sample of 311 (100 each in Arizona and Oklahoma and 111 total in the Dakotas) nonparticipants was interviewed to obtain information about diabetes and some major CVD risk factors. Results of the comparison are reported in a separate study[14] that focuses on recruitment of the study participants. Briefly, there is a higher participation rate among women, and the participants are slightly younger than the nonparticipants (mean ages 56 and 58 years, respectively). Overall, the rate of self-reported diabetes was similar in the participants (40%) and nonparticipants (38%).

Approximately 4% of the eligible participants, more men than women, refused the OGTT (84 men and 56 women), and a small number of blood samples (n= 65) were lost during shipping to the core laboratory in Washington, DC. Thus, of the 4,549 participants examined, diabetes status was determined for 4,304 (95%; 1,446 in Arizona, 1,449 in Oklahoma, and 1,409 in the Dakotas). Among them, 831 had known diabetes (499 taking insulin and 332 taking oral agents) and 61 were on dialysis or had kidney transplants (45 in Arizona, 11 in the Dakotas, and 5 in Oklahoma). A total of 1,512 participants were classified as having NGT, including 44 participants who indicated that they were told by a health professional that they had diabetes at one time but were not taking insulin or hypoglycemic agents and had no abnormal blood glucose values or evidence of therapy seen in medical records.

Table 1 shows the age- and sex-specific and standardized prevalence rates and the total number of participants with IGT and diabetes by center. In all three centers, diabetes was more prevalent in women than in men. Arizona had the highest age-adjusted rates of diabetes, 65% in men and 72% in women. While Arizona had the highest rate of diabetes in both men and women and in every age category, IGT rates were comparable in men among the three centers. In women, the rates of IGT were lower in Arizona than in the other two centers. No substantial differences were found in the rate of diabetes between Districts 1-5 of the Gila River Indian Community (65% in men and 73% in women) and other districts of the Gila River Indian Community and the Salt River Indian Community combined (63% in men and 69% in women). Districts 1-5 of the Gila River Indian Community have been the site of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) longitudinal diabetes study for the last 25 years. Diabetes rates in Oklahoma (38% in men and 42% in women) and the Dakotas (33% in men and 40% in women) were similar to each other and considerably lower than those in Arizona. In Oklahoma and the Dakotas, prevalence rates were higher in each successive age-group. In Arizona, the rate was lower in both men and

women after age 65. The IGT rate in Arizona was slightly higher in the 65- to 74-year-old than in the younger age-groups, while this was not observed in Oklahoma or the Dakotas.

Table 2 shows the prevalence of known cases and new diagnosed cases by center. Among the three centers, Arizona had the lowest new:known ratios. For every 10 known cases of diabetes, there were approximately 1 to 2 patients with newly diagnosed diabetes. A close examination of the two Arizona Indian Communities (Gila River and Salt River) revealed that Gila River Districts 1-5 had a lower new:known ratio than the other districts (0.15 vs. 0.17 in men and 0.13 vs. 0.14 in women). In Oklahoma and the Dakotas, for every 10 known cases, there were 3 to 7 new cases. The overall ratio in men was higher in the Dakotas than in Oklahoma, but the reverse was observed in women. The highest ratio occurred in the 65- to 74-year-old men in the Dakotas (0.67), indicating a considerable

Table 1. Age- and Sex-specific and standardized prevalence of IGT and diabetes in three American Indian populations.

	Arizona			Oklahoma			South and North Dakota			Total		
	n	IGT(%)	Diabetes (%)	n	IGT(%)	Diabetes (%)	n	IGT(%)	Diabetes (%)	n	IGT(%)	Diabetes (%)
Men												
Age (years)												
45-54	301	14	63	311	14	30	303	12	30	915	13	41
55-65	152	13	72	189	13	40	208	15	34	549	14	47
65-74	68	22	57	118	19	47	94	15	35	280	18	45
All ages	521	15	65	618	15	36	605	13	32	1,744	14	43
Age-standardized prevalence (%)		15	65		15	38		14	33		15	44
95% CI		12.0-18.8	60.3-69.1		12.0-17.8	33.9-41.8		10.7-16.4	29.0-36.8		12.8-16.3	41.7-46.5
Women												
Age (years)												
45-54	471	14	65	363	23	32	389	22	33	1,223	19	45
55-65	306	12	78	296	14	47	271	17	51	873	14	59
65-74	148	16	74	172	21	49	144	19	56	464	19	59
All ages	925	14	71	831	19	41	804	20	43	2,560	17	52
Age-standardized prevalence (%)		14	72		19	42		19	46		17	54
95% CI		11.6-16.4	69.3-75.3		16.4-21.8	38.6-45.4		16.4-22.1	42.1-49.1		15.8-18.8	51.9-55.9
Total age-standardized prevalence (%)		14	70		17.3	40		17	40		16	50
95% CI		12.5-16.5	67.2-72.2		15.3-19.2	37.7-42.8		14.8-18.9	37.5-42.8		15.1-17.3	48.5-51.6

CI = confidence interval

Table 2. Prevalence of newly diagnosed and known cases of diabetes in three American Indian populations.

	Arizona			Oklahoma			South and North Dakota			Total		
	New	Known	Ratio	New	Known	Ratio	New	Known	Ratio	New	Known	Ratio
Men												
Age (years)												
45-54	7	55	0.13	8	23	0.35	9	21	0.43	8	33	0.24
55-65	12	60	0.20	11	30	0.37	11	24	0.46	11	36	0.31
65-74	9	49	0.18	10	36	0.28	14	21	0.67	11	34	0.32
All ages	9	56	0.16	9	27	0.33	10	22	0.45	9	34	0.26
Women												
Age (years)												
45-54	9	56	0.16	9	22	0.41	10	24	0.42	9	36	0.25
55-65	9	69	0.13	12	35	0.34	10	41	0.24	10	49	0.20
65-74	6	68	0.09	13	36	0.36	13	42	0.31	11	48	0.23
All ages	8	62	0.13	11	30	0.37	10	33	0.30	10	43	0.23

Data are %.

Table 3. Prevalence of diabetes and age at diagnosis by parental diabetes status, sex, and center.

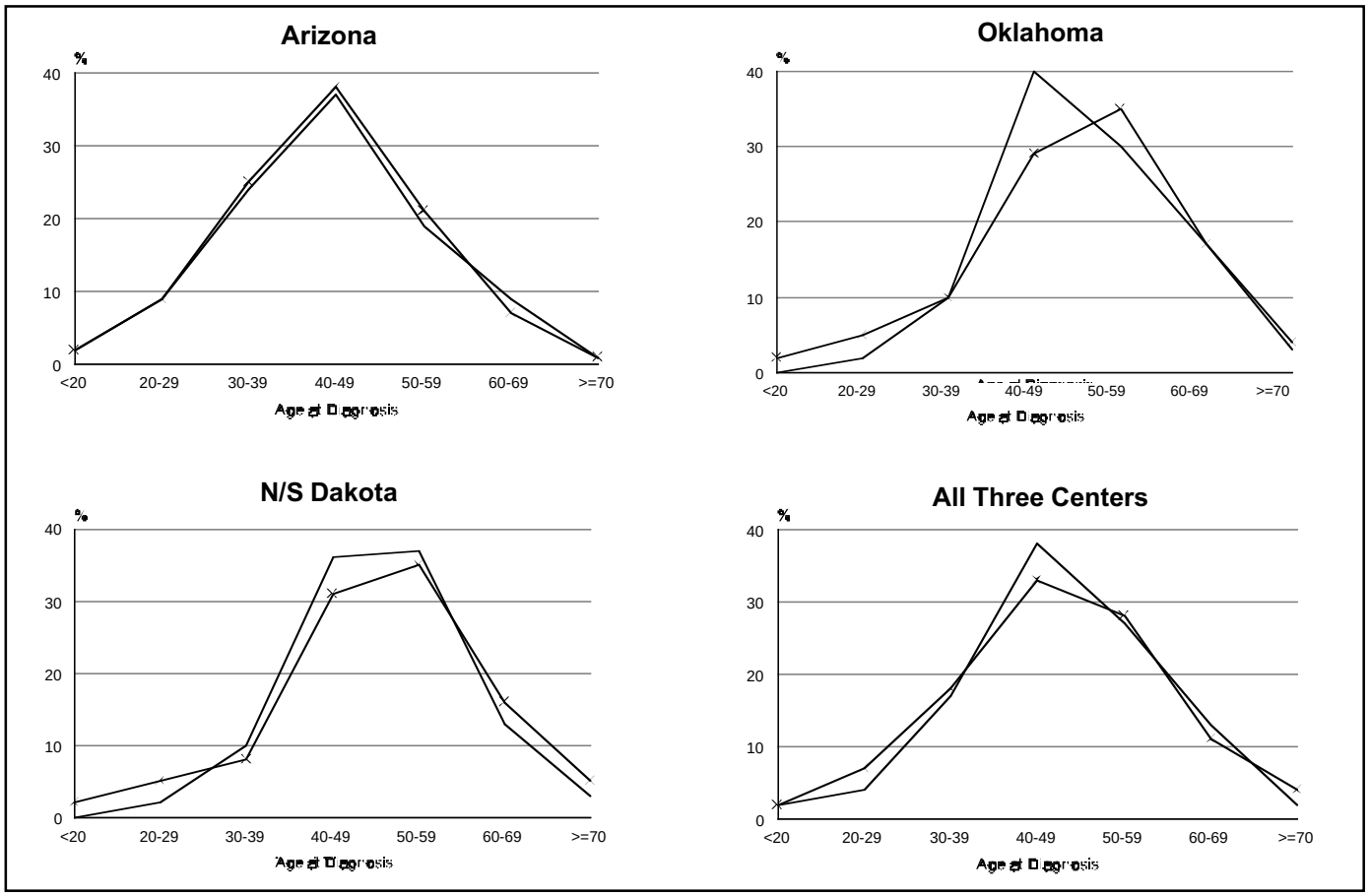
Parental diabetes status	Arizona		Oklahoma		South and North Dakota	
	Prevalence(%)	Age(years)	Prevalence(%)	Age(years)	Prevalence(%)	Age(years)
Men						
Neither	57.1	46.6	29.1	51.8	30.6	53.0
Either	69.6	42.4	41.8	49.7	37.5	47.9
Both	71.9	38.3	47.1	45.4	48.2	45.7
Women						
Neither	63.9	46.4	31.7	53.3	33.3	52.2
Either	73.3	41.8	48.0	48.4	44.7	49.6
Both	76.6	39.6	61.5	50.3	63.8	46.9

reservoir of undiagnosed cases of diabetes in this group. In Oklahoma, the highest ratio occurred in women aged 45-54 (0.41).

In the participants known to be diabetic, the mean duration of diagnosed diabetes was the longest in Arizona (14.37 years) compared with that in Oklahoma (7.8 years) and the Dakotas (6.9 years). Of the diabetic patients in Arizona, diabetes had been diagnosed for >10 years in 58% and for >20 years in 31%. The duration distribution of the Oklahoma patients was similar to that of South and North Dakota, in that diabetes was diagnosed for 5 years before the Strong Heart Study examination in 45% of the patients in the Dakotas and 50% of those in Oklahoma.

Parental diabetes status. Of those participants whose diabetes status was determined (n= 4,304), 26% of the women and 29% of the men did not know whether diabetes had been diagnosed in one or both of their parents. Table 3 gives the percentage of diabetic subjects and

Figure 2. Distribution of age at diagnosis (—, men; x, women).



mean age at diagnosis by sex, center, and diabetic status of parents (among those with known parental status only). Diabetes rates were not different between participants who had only a diabetic father or only a diabetic mother, and thus, they were combined. Parental diabetes was significantly associated ($P < 0.01$) with diabetes; the prevalence of diabetes increased with the number of diabetic parents. The rates of diabetes in offspring of two diabetic parents were almost twice those in offspring with no diabetic parents among the women in Oklahoma and the Dakotas. Overall, the prevalence odds ratios were 1.84 and 1.80 in men and women, respectively, for individuals with one or two diabetic parents relative to those without any diabetic parents. No clear patterns were found between the rate of IGT and parental diabetes status (data not shown).

Age at diagnosis. Table 3 also shows that parental diabetes status was related to age at diagnosis. Diabetes was diagnosed at a younger age in participants with one or both parents having diabetes than in those with neither parent having diabetes. In each parental diabetes status group, the average age at diagnosis was significantly lower for Arizona diabetic participants ($P < 0.05$) than for those from Oklahoma and from South and North Dakota.

Figure 2 (Arizona, Oklahoma, and North and South Dakota) shows the distributions of reported age at diagnosis for all diabetic participants by centers. Age at diagnosis peaked during the 4th decade of life for both men and women in Arizona. The average age at diagnosis in Districts 1-5 of the Gila River Indian Community was approximately the same as that in the other districts. In Oklahoma, diabetes was diagnosed in men at a younger age (peaked in 40-49 years) than in women (peaked in 50-59 years). In South and North Dakota, the distributions for men and women are similar, but an almost equal percentage of participants has diabetes diagnosed in the 4th decade as in the 5th decade. When all three centers are combined, a single peak during the fourth decade was observed because of the dominating effect of the large number of diabetic patients in Arizona.

Obesity. Obesity is prevalent in all three centers. Among them, Arizona had the highest prevalence of obesity (75%; BMI ⊕27.8 for men and ⊕27.3 for women), followed by Oklahoma (70%) and the Dakotas (62%). The average BMIs in men (women) were 31.1 (33.1), 30.2 (31.3). and 28.5 (30.1), respectively, in Arizona, Oklahoma, and South and North Dakota. For the men of all three centers and the women in Arizona, the average BMI was highest in the 45- to 54-year-old group and lowest in the 65- to 74-year-old group. Figure 3 shows the overall prevalence of diabetes by BMI in men and women in the three centers combined. The rate of diabetes increased steadily with increasing BMI in both sexes, except that it declined slightly in women in the highest BMI group.

In Oklahoma and in North and South Dakota, there was a consistent pattern of significantly increased prevalence rates of diabetes across the normal, overweight, and obese groups ($P < 0.001$; Table 4). Similar results were obtained using percentage body fat. In the Arizona men, diabetes rates were slightly lower in the most obese (based on BMI), although the differences were not statistically significant. Similar results were observed in the Arizona women when percentage body fat was used. Women in all three centers with a WHR ⊕ 0.96 had a significantly ($P < 0.001$) higher rate of diabetes than those with a WHR < 0.96. We also examined the association of obesity using BMI and percentage body fat and diabetes prevalence, taking age into consideration. Overall, the rate of diabetes increased significantly ($P < 0.05$) in the obese group after adjustment for age (data not shown). However, the association between the prevalence of IGT and degree of obesity was not so consistent across centers or sex. Only in Arizona were IGT rates slightly higher in the obese group than the overweight and normal weight groups, in both men and women. Participants with ⊕ 34% body fat had slightly higher IGT rates than those with less

Figure 3. Prevalence of diabetes by age, sex, and body mass index (BMI).

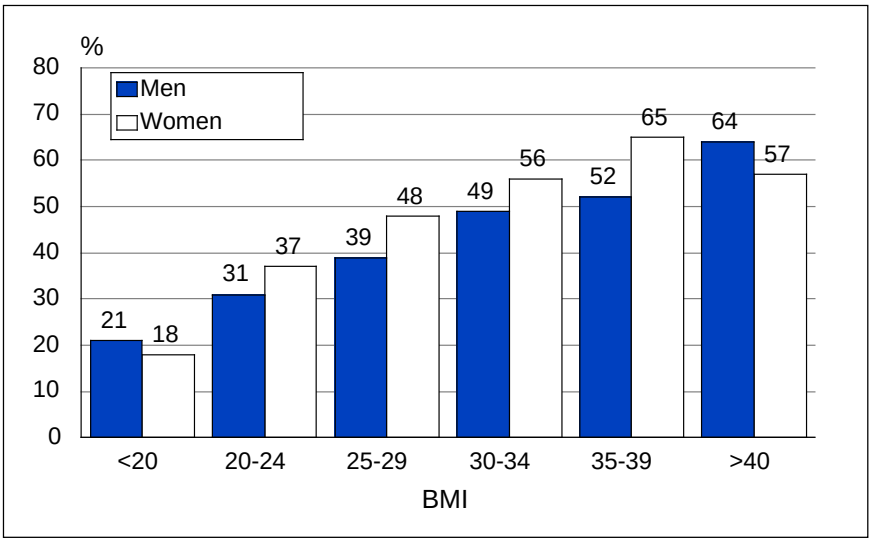


Table 4. Prevalence of diabetes and IGT by sex, obesity, percentage body fat, WHR, and center.

	Arizona			Oklahoma			South and North Dakota		
	%	Diabetes	IGT	%	Diabetes	IGT	%	Diabetes	IGT
Men									
Obesity									
Normal weight	33.1	63.9	13.9	35.4	28.6*	11.1	46.4	19.4*	8.4
Overweight	26.0	68.7	10.5	24.5	26.3	17.8	27.1	38.6	13.9
Obese	40.9	62.0	18.3	40.1	49.6	15.7	26.5	47.3	20.6
Body fat (%)									
⊕34	40.4	63.0†	19.2	38.5	45.8*	19.1	31.0	45.4*	22.2
<34	59.6	64.9	11.9	61.5	30.0	11.9	69.0	26.3	9.6
WHR									
⊕0.98	39.7	64.1	17.5	37.7	45.2*	14.8	51.5	14.0*	17.0
>0.98	60.3	65.6	12.2	62.3	31.2	14.7	48.5	23.4	9.8
Women									
Obesity									
Normal weight	19.9	72.5	10.1	29.2	20.6*	21.9	34.2	31.6*	18.2
Overweight	29.9	73.9	11.2	30.9	38.0	21.3	33.5	43.4	21.5
Obese	50.3	68.4	16.8	40.0	57.3	15.8	32.4	54.2	19.5
Body fat (%)									
⊕45	43.4	67.3†	18.2	37.3	50.3*	18.1	29.4	52.2*	20.0
<45	56.6	73.5	10.4	62.7	34.8	20.0	70.6	38.6	19.8
WHR									
⊕0.96	50.6	77.7*	11.5	26.6	51.8*	15.3	38.2	52.8*	19.6
<0.96	49.4	63.9	16.4	73.4	36.8	20.7	61.8	36.2	19.6

* P< 0.001; †P < 0.05; WHR = waist/hip ratio; normal weight = BMI < 27.8 for men and < 27.3 for women; overweight = BMI 27.8 - 31.09 for men and 27.3 - 32.29 for women; obese = BMI ⊕31.1 for men and ⊕32.3 for women.

body fat except for the Oklahoma women. Men with a WHR ⊕ 0.98 had slightly higher IGT rates than those with lower WHR. However, none of the differences was statistically significant.

Table 5 compares the diabetes and IGT rates of the Strong Heart Study populations to NHANES II data[15] by parental diabetes status and level of obesity. In Oklahoma and South and North Dakota, the presence of either obesity or diabetic parents increased the total diabetes rate, and both factors together increased the rate almost threefold. Also, obesity was more closely associated with diabetes prevalence than parental diabetic status in these two centers. However, in Arizona, where both obesity and diabetes were most prevalent, parental diabetes appeared to be a more dominating factor than obesity. The rates of new diabetes were, in general, higher in the obese group than in the nonobese group. In the nonobese group, the rate of new diabetes in those with parents having diabetes was equal to or smaller than that in those without parents having diabetes. The reverse was

Table 5. Diabetes and IGT rates (weighted to U.S. population) according to parental diabetes status and level of obesity as compared with NHANES II data.

	Nonobese								Obese							
	No diabetic parent				Diabetic parent				No diabetic parent				Diabetic parent			
Diagnostic category	AZ	OK	SD/ ND	NHANES	AZ	OK	SD/ ND	NHANES	AZ	OK	SD/ ND	NHANES	AZ	OK	SD/ ND	NHANES
Known diabetes	56.0	12.6	11.9	3.5	67.0	20.7	17.8	10.6	52.1	26.1	29.6	6.2	65.1	39.7	36.9	13.9
New diabetes	7.0	6.8	5.3	3.9	7.0	3.7	2.0	3.5	11.5	10.7	11.9	8.6	7.4	11.9	12.7	14.3
Total diabetes	63.0	19.4	17.2	7.4	74.0	24.4	19.8	14.1	63.6	36.8	41.5	14.8	72.5	51.6	49.6	28.2
IGT*	9.0	15.3	11.5	12.8	11.0	14.6	5.9	19.7	17.6	19.8	18.8	21.5	13.2	15.2	20.2	31.1

Data are %
* WHO criteria

Table 6. Diabetes rates of participants by sex, center, and amount of Indian ancestry.

Amount of Indian ancestry(%)	Men						Women					
	AZ		OK		SD/ND		AZ		OK		SD/ND	
<25	–		0	(1)	8.3	(24)	–		0	(1)	5.6	(36)
25-49	–		13.8	(29)	20.2	(89)	0	(1)	11.5	(26)	13.9	(79)
50-74	58.8	(17)	25.9	(108)	24.2	(95)	66.7	(24)	29.6	(125)	44.4	(108)
75-99	60.0	(20)	27.3	(33)	38.8	(121)	64.5	(31)	46.9	(49)	43.9	(171)
100	65.1	(484)	41.2	(447)	38.4	(276)	71.4	(869)	43.8	(630)	51.2	(410)

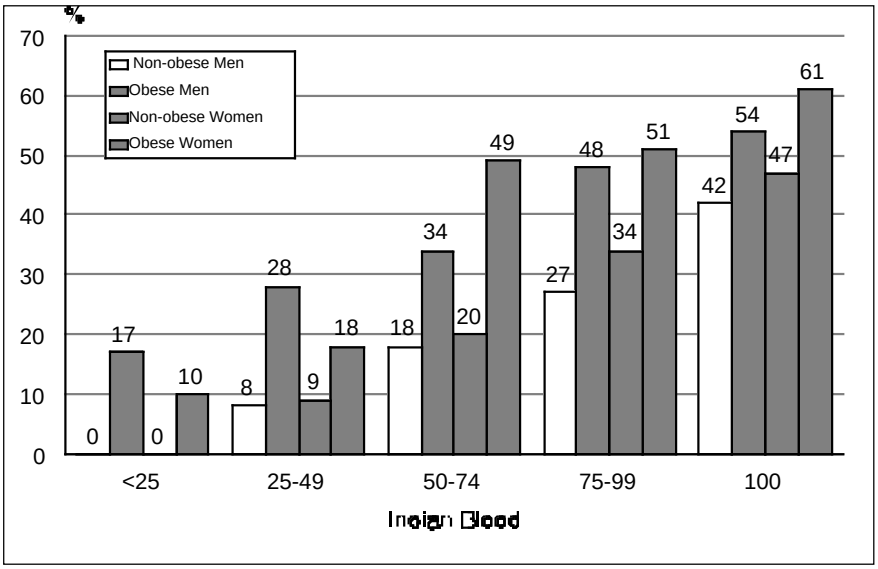
Data are % (n).

observed in the obese group. Thus, there appeared to be a considerable reservoir of undiagnosed cases of diabetes in the obese group and in the nonobese group with no parents having diabetes.

Amount of Indian ancestry. Self-reported amount of Indian ancestry (as a percentage) was available from 95% of the participants. The Arizona participants have the highest reported quantum of Indian ancestry (average 98%, 93.6% full-blood), followed by the Oklahoma participants (average 88%, 74.3% full-blood) and the Dakota participants (average 79%, 48.7% full-blood). None of the participants in Arizona had < 50% Indian ancestry and all the Oklahoma participants had at least 25% Indian ancestry. Figure 4 shows that the prevalence of diabetes increased with degree of Indian ancestry in both the overweight or obese (BMI ⊕ 27.3 for women, ⊕ 27.8 for men) and nonobese subgroups. Table 6 gives diabetes rates by sex, center, and amount of Indian ancestry. The rate of diabetes increased consistently in all three centers with amount of Indian ancestry. The prevalence in individuals with 50% or more Indian ancestry was significantly ($P < 0.0001$) higher than that in those with < 50% Indian ancestry. In South and North Dakota, diabetes rates in the full-blood Indians were more than four and nine times higher in men and women, respectively, than in the Indians with < 25% Indian ancestry. The full-blood Indians in Oklahoma had more than three times higher diabetes rates than those reporting 25-49% Indian ancestry. The differences in diabetes rates among the groups defined by degrees of Indian ancestry (Table 6) are highly significant ($P < 0.01$) in both the Dakotas and Oklahoma, even after controlling for the effect of obesity.

Figure 5 shows the prevalence of diabetes of participants stratified by number of diabetic parents, obesity status, and amount of Indian ancestry. For participants with at least 50% Indian ancestry, the rates are also stratified by center. Clearly, individuals with < 50% Indian ancestry had much lower diabetes rates than those with at least 50% Indian ancestry. The obese group had higher rates than the nonobese group, and participants with parents having diabetes had higher rates than those with no parents having diabetes. In participants with at least 50% Indian ancestry, the rates increased with obesity and the number of diabetic parents. Similar results were obtained when the number of diabetic parents was replaced by age (data not shown).

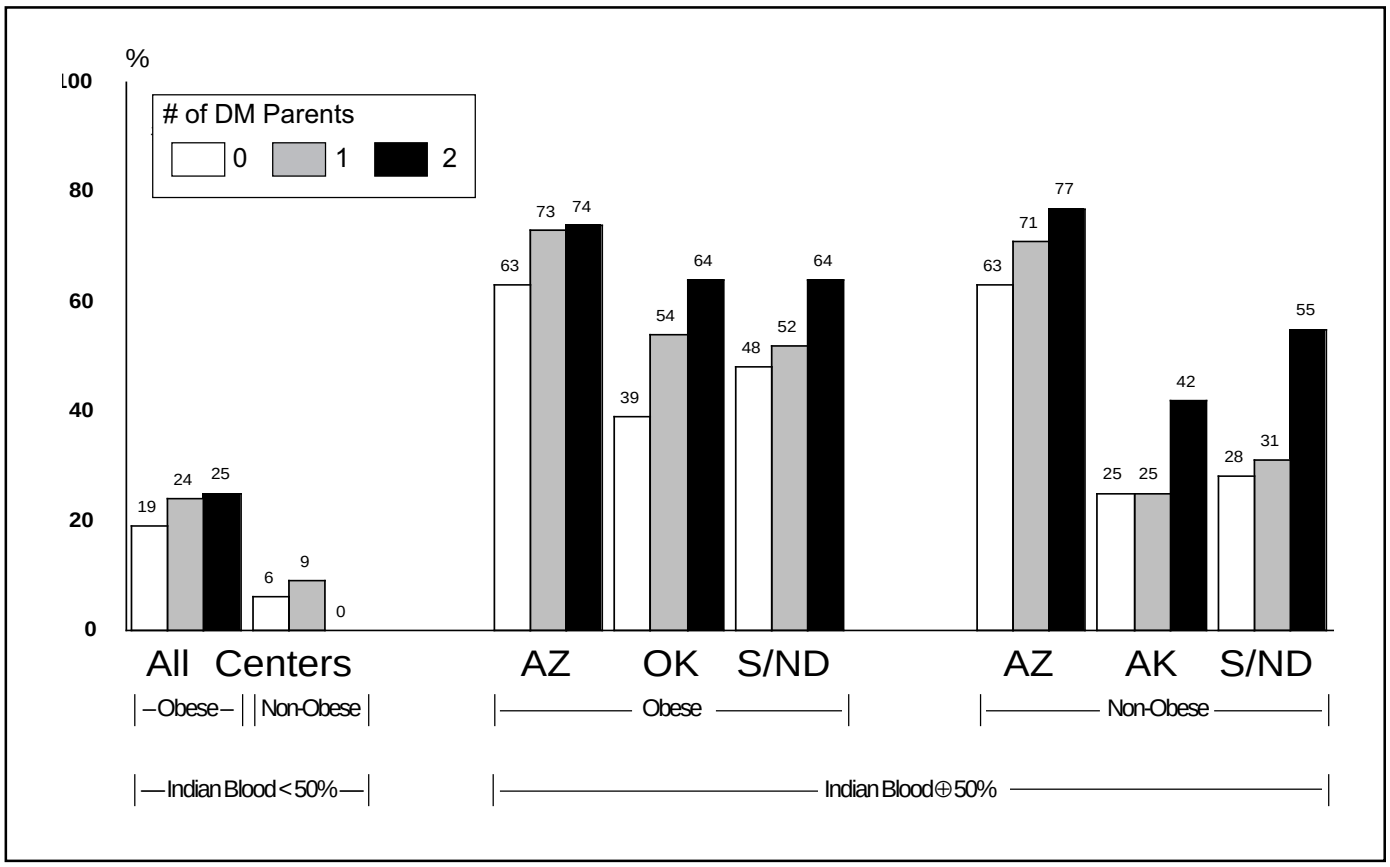
Figure 4. Prevalence of diabetes by Indian ancestry, sex, and obesity.



Conclusions

The Strong Heart Study is the first study in which standardized criteria were used to diagnose diabetes and IGT in multiple American Indian populations. Diabetes rates in the three Indian populations have all reached epidemic proportions. The Pima/Maricopa/Papago Indian communities have the highest diabetes rates (65% in men and 72% in women) among the three centers. These

Figure 5. Prevalence of diabetes by Indian ancestry, obesity, center, and parental diabetes.



rates may also be the highest among all populations in the world.[16] The prevalence of diabetes in Oklahoma (38% in men and 42% in women) and the Dakotas (33% in men and 40% in women), although lower than those in Arizona, are much higher than those reported for other U.S. populations. The comparison between participants and nonparticipants shows that participants are younger (an average of 2 to 4 years younger among the men and women in the three centers). The estimated rates may be lower than the true rates in the communities. On the other hand, women had a higher participation rate, and diabetes rates are higher in women, which may lead to an overestimate. We believe that the estimation biases are very small.

The 1976-1980 NHANES II[15] reported that in the U.S. population, a history of diabetes was reported for 4.3%, 6.6%, and 9.3% of the 45- to 54-, 55- to 64-, and 65- to 74-year-old age-groups, respectively. The prevalence was higher in men than in women and in blacks than in whites. Rates of undiagnosed diabetes in NHANES II were similar to the rates for known diabetes. Rates of IGT using WHO criteria[10,11] were 14.8%, 15.1%, and 22.8%, respectively, in the three above-listed age-groups. More recently, the Centers for Disease Control[17] reported that based on their Behavioral Risk Factor Surveillance System, the prevalence of self-reported diabetes ranged from 4.0% among individuals aged 35-54 years to 12.5% among individuals aged 65-74 years. A population-based study in Minnesota[18] showed similar rates of NIDDM (93.2 per 1,000 in individuals aged 40 to 59 years and 206.8 per 1,000 in those older than 60) and IGT (183.3 per 1,000 in individuals aged 40 to 59 years and 294.8 per 1,000 in those over 60). The rates of NIDDM and IGT were 11.9% and 27.8%, respectively, in a California community of adults aged 40 to 79 years.[19]

While the rates of IGT obtained by the Strong Heart Study were comparable with or slightly lower than those reported from these studies, which included largely white populations, the rates of diabetes in the Strong Heart Study populations were four to eight times higher. Although different ascertainment methods were used, it is unlikely that variation in study design and methods alone could account for the large differences in the rate of diabetes between white and American Indian populations.

In addition to blacks, Hispanic men and women have a higher prevalence of NIDDM than non-Hispanic whites.[20] The age-adjusted prevalences of NIDDM were 9.9% and 10.7%, respectively, in Hispanic men and women aged 30 to 69 years, compared with 4.5% and 3.5% in the non-Hispanic whites. The San Antonio Heart Study[21] had similar results, with prevalence rates in Hispanic men ranging from 5.5% to 13.4% and in Hispanic women ranging from

3.7% to 13.7%. The lowest prevalence rates were seen in those living in suburban San Antonio. The Hispanic Health and Nutrition Examination Survey in 1982-1984[22] found that among the 45- to 74-year-old Mexican-Americans, 13.4% of the men and 15.2% of the women had diabetes. These rates, although higher than those reported by the NHANES II for the white population, were still much lower than those obtained by the Strong Heart Study.

There have been several previous epidemiological studies to determine the prevalence of NIDDM in different Indian tribes. However, methods used to ascertain NIDDM varied; some studies used OGTT tests and others were based on self-reported data or other patient information databases. The 1987 Survey of American Indians and Alaska Natives showed that based on self-reported data, the age-/sex-adjusted prevalence rate of diabetes was 12.2%, which was 2.35 times higher than that in the general U.S. population.[23] In the Pima tribe of Arizona, a tribe that has participated in an NIDDK-sponsored longitudinal study of diabetes for over 25 years (Districts 1-5 of the Gila River Indian Community), the prevalence rates of NIDDM increased from 3.2% (all ages) in the early 1950s to 19% (age ⊕5 years) in the 1960s.[24] There was a 42% increase in age-adjusted diabetes prevalence rates between 1967 and 1977.[26] By the early 1980s, 50% of Pima Indians older than age 35 had diabetes.[25] Between 1982 and 1990, the prevalence of diabetes in those older than 35 years of age ranged from 46% (women between 35 and 44 years) to 74% (women over 65 years).[27] In this study, fasting glucose levels and OGTTs were used at the biennial examination to classify diabetes according to WHO criteria,[10,11] and the reported diabetes rates were very similar to those obtained by the Strong Heart Study. This ongoing study of NIDDK may have promoted early detection and thereby produced a slightly lower new:known diabetes ratio than in other areas of the Arizona center (0.15 vs. 0.17 in men and 0.13 vs. 0.14 in women). In fact, the overall prevalence rate of newly diagnosed cases in the Strong Heart Study was 10%, much lower than the nearly 50% found in the NHANES II.[15] The lower proportion of newly diagnosed cases may have resulted from the high suspicion level of the health care providers at the Indian Health Service facilities and their efforts in increasing the awareness of diabetes and promoting early detection.

Although no other tribes have been studied as extensively as the Pima, scattered reports have shown varying rates of diabetes in other tribes. The overall age-adjusted prevalence of diabetes, 15.7 per 1,000, in the Alaskan Eskimos, Indians, and Aleuts was lower than the overall U.S. rate of 24.7 per 1,000.[5] Among these three populations, prevalence rates ranged from 8.8 per 1,000 for the Eskimos to 22.0 per 1,000 for the Indians and 27.2 per 1,000 for the Aleuts. Diabetes cases were ascertained from the Patient Care Information System established by the Indian Health Service in Alaska and verified by chart review. The Navajo Indians, the largest Indian tribe in the U.S., were classified as having a low prevalence of diabetes in the 1970s.[1] However, a recent report[4] showed that estimated age-adjusted prevalence rates for the Navajo between 20 and 74 years of age were 13.9% and 18.4% for men and women, respectively, which were 2.5 times the U.S. rates. In this study, diabetes was ascertained according to the critera of WHO[11] for the OGTT. In a study of 29,000 American Indians living on or near 10 reservations in the Pacific Northwest (Washington, Oregon, and Idaho), the Indian Health Service facilities' records showed an age- and sex-adjusted prevalence rate of 7.1%, which was three times higher than the comparable U.S. rate in 1980.[6] The age-adjusted prevalence of diabetes among all Bands of Sioux in the Dakotas in 1987 was 236.1 per 1,000 for those aged 45 to 64 years and 267.9 per 1,000 for those aged 65 or over.[28] The 1987 age-adjusted prevalence of diabetes for all ages among the three Sioux tribes included in the Strong Heart Study, based on ambulatory care data, ranged from 2.8 to 4.5 times the U.S. rate.[29]

Some Indian reservations had prevalence rates of diabetes close to those found in the Strong Heart Study. For example, in the Warm Springs Reservation community, women aged 55 to 64 years had a prevalence rate of 46.7%.[6] In addition, the prevalence rates of diabetes among the Navajos approach those in the Strong Heart Study in some older age groups[4]; rates ranged from 26.7% in men aged 45 to 54 to 45.7% in women aged 55 to 64 years. It appears that, besides the Pima, only the Naurus of the Pacific Ocean had a reported diabetes prevalence (approximately 41.5% in the age range 30 to 64 years) close to those found in the Strong Heart Study.[30]

Age, obesity, parental diabetes, and degree of Indian ancestry have been consistently and strongly associated with diabetes.[1,5,25,27,31] The prevalence of diabetes was higher in older age groups in all three centers of the Strong Heart Study except Arizona, where the rate was lower in those older than 65 years. This may be due to a possible cohort effect or excess mortality rates in this population.[33,34] In the Pima Indians, several risk factors have been reported to predict the development of diabetes. These include age, diet, obesity, genetic markers, and parental diabetes.[25,27] Similar results were observed in the Strong Heart Study. In addition, we found that the rates of diabetes were significantly higher in persons with greater amounts of Indian ancestry, similar to results obtained in other Northern Plains Tribes in North Dakota.[35]

The reason for the high prevalence of diabetes in the Indian population remains unclear. However, the increasing diabetes rates in persons with higher amounts of Indian ancestry provide strong evidence that Indian race is

highly associated with the disease. Our observation is that obesity has increased over the last few decades, and it has occurred in young individuals, even children. Diabetes has also been diagnosed in young American Indians. All this supports the "thrifty" genotype hypothesis. More genetic studies are needed.

Interestingly, the prevalence of IGT in our study cohorts was similar to that of the general U.S. population, but the prevalence of diabetes was much higher. Does this imply that the glucose values of many Native Americans increase rapidly from normal to diabetic levels without going through an IGT period? Our ongoing follow-up study will be able to shed some light on this issue.

Standards of care have been developed and implemented by the Indian Health Service for those American Indians in whom diabetes has been diagnosed, emphasizing therapy, diet, and exercise to improve glycemic control or reduce the risk of development of diabetic complications. The extent of implementation is being monitored periodically. Further study is needed to define the most effective intervention for patients with IGT and newly diagnosed diabetes. However, the best strategy would be the prevention of IGT and diabetes. Currently, screening for diabetes is not included in national recommendations for preventive care. Because of the epidemic of diabetes in American Indians, regular screening with a OGTT (75g) should be considered for American Indians older than 40 years of age, particularly those who are overweight and those who have diabetic parents or a high amount of Indian ancestry. In addition, much more needs to be done in developing effective programs for preventing diabetes.

Acknowledgments

This study was supported by grants U01 HL-41642, U01 HL-41652, and U01 HL-41654 from the National Heart, Lung, and Blood Institute.

We wish to express our appreciation for the 13 American Indian tribes/communities (Ak Chin Papago/Pima, Gila River Pima/Maricopa, and Salt River Pima/Maricopa in Arizona; Apache, Caddo, Comanche, Delaware, Fort Sill Apache, Kiowa, and Wichita in Oklahoma; and Cheyenne River Sioux, Oglala Sioux, and Devil's Lake Sioux in South and North Dakota) for their support and participation, and to the Indian Health Service and its clinics and hospitals at each site for their endorsement and assistance. We also wish to thank the coordinators of the Strong Heart Study field centers: Beverly Blake, Betty Jarvis, and Martha Stoddart and the Strong Heart Study staff.

References

1. West K. Diabetes in American Indians. *Adv Metab Disord*. 1978;9:29-46.
2. Sievers ML, Fisher JR. Diabetes in North American Indians. In: Harris MI, Hamman RF, eds. *Diabetes in North American Indians.* Washington, DC: U.S. Government Printing Office; 1985:X1-1-X1-20. DHHS publication no. 85-1468.
3. Nelson RG, Everhart JE, Knowler WC, Bennett P. Incidence, prevalence, and risk factors for non-insulin-dependent diabetes mellitus. *Primary Care*. 1988;15:227-250.
4. Sugarman JR, Gilbert TJ, Weiss NS. Prevalence of diabetes and impaired glucose tolerance among Navajo Indians. *Diabetes Care*. 1992;15:114-120.
5. Schraer CD, Lanier AP, Boyko EJ, Gohdes D, Murphy NJ. Prevalence of diabetes mellitus in Alaskan Eskimos, Indians, and Aleuts. *Diabetes Care*. 1988;11:693-700.
6. Freeman WL, Hosey GM, Diehr P, Gohdes D. Diabetes in American Indians of Washington, Oregon, and Idaho. *Diabetes Care.* 1989;12:282-288.
7. Indian Health Service. *Indian Health Service Trends in Indian Health.* Washington, DC: U.S. Department of Health and Human Services, Public Health Service; 1993.
8. Katzeff HL, Savage PJ, Barclay-White B, Nagulesparan M, Bennett PH. C-peptide measurement in the differentiation of type 1 (insulin-dependent) and type 2 (non-insulin-dependent) diabetes mellitus. *Diabetologia*. 1985;28:264-268.
9. Lee ET, Welty TK, Fabsitz R, *et al*. The Strong Heart Study, a study of cardiovascular disease in American Indians: design and methods. *Am J Epidemiol*. 1990;136:1141-1155.
10. *WHO Expert Committee on Diabetes Mellitus, Second Report*. Geneva, Switz: World Health Organization; 1980. Technical Report Series No. 646.
11. *Diabetes Mellitus: Report of a WHO Study Group.* Geneva, Switz: World Health Organization; 1985. Technical Report No. 727.
12. Najjar MF, Rowland J. Anthropometric reference data and prevalence of over-weight, United States, 1976-1980. *Vital Health Stat*. 1987;11:238. Department of Health and Human Services publication (PHS) 87-1688.
13. Lee ET. *Statistical Methods of Survival Data Analysis.* 2nd ed. New York, NY: Wiley; 1992.
14. Stoddart MK, Blake B, Fabsitz R, Jarvis B for the Strong Heart Study Investigators. Recruitment of American Indians in epidemiological research: the Strong Heart Study. In: *Proc of the American Public Health Association Annual Meeting; San Francisco; 1993.*
15. Harris MI, Hadden WC, Knowler WC, Bennett PH. Prevalence of diabetes and impaired glucose tolerance and plasma glucose levels in U.S. population aged 20-74 years. *Diabetes*. 1987;36:523-534.
16. Jarrett RJ. Epidemiology and public health aspects of non-insulin-dependent diabetes mellitus. *Epidemiol Rev*. 1989;11:151-171.
17. Centers for Disease Control. Regional variation in diabetes mellitus prevalence: United States, 1988 and 1989. *MMWR*. 1990;39(45):805-812.
18. French LR, Boen JR, Martinez AM, Buchhouse SA, Sprafka JM, Goetz FC. Population-based study of impaired glucose tolerance and type II diabetes in Wadena, Minnesota. *Diabetes*. 1990;39:1131-1137.
19. McPhillips JB, Barrett-Connor E, Wingard DL. Cardiovascular-disease risk factors before the diagnosis of impaired glucose tolerance and non-insulin-dependent diabetes mellitus in a community of older adults. *Am J Epidemiol*. 1990;131:443-453.
20. Hamman RF, Marshall JA, Baxter J, *et al*. Methods and prevalence of non-insulin-dependent diabetes mellitus in a biethnic Colorado population. *Am J Epidemiol*. 1989;129:295-311.
21. Stern MP, Rosenthal M. Haffner SM, Hazuda HP, Franco LJ. Sex difference in the effects of sociocultural status on diabetes and cardiovascular risk factors in Mexican Americans: the San Antonio Study. *Am J Epidemiol*. 1986;123:96-112.
22. Flegal KM, Ezzati TM, Harris MI, *et al*. Prevalence of diabetes in Mexican Americans, Cubans, and Puerto Ricans from the Hispanic Health and Nutrition Examination Study, 1982-1984. *Diabetes Care*. 1991;14.628-638.
23. Johnson A, Taylor A. *Prevalence of Chronic Diseases: A summary of Data from the Survey of American Indians and Alaska Natives. National Medical Expenditure Survey Data Summary 3.* Rockville, MD: Agency for Health Care Policy and Research (AHCPR), Public

Health Service; 1991. AHCPR publication No. 91-0031.
24. Bennett PH, Miller M. Diabetes mellitus in Indians of the southwestern United States. In: *Proc of the 7th Congress of the International Diabetes Federation.* Amsterdam: Excepta Medica Foundation; 1970:318-324. Excepta Medica Int. Congr. Serial No. 231.
25. Knowler WC, Pettitt DJ, Savage PJ, Bennett PH. Diabetes incidence in Pima Indians: contributions of obesity and parental diabetes. *Am J Epidemiol*. 1981;113:144-156.
26. Bennett PH, Knowler WC. Increasing prevalence of diabetes in the Pima (American) Indians over a ten-year period. In: Waldhausl WK, ed. *Proc 10th Congress of the International Diabetes Federation.* Amsterdam: Excepta Medica; 1979:507-511.
27. Knowler WC, Saad MF, Pettitt DJ, Nelson RG, Bennett PH. Determinants of diabetes mellitus in the Pima Indians. *Diabetes Care*. 1993;16 (Suppl. 1):216.227.
28. Gohdes D, Kaufman S, Valway S. Diabetes in American Indians, an overview. *Diabetes Care* 16 (Suppl. 1):239-243.1993
29. Stahn RM, Gohdes D, Valway SE. Diabetes and its complications among selected tribes in North Dakota, South Dakota, and Nebraska. *Diabetes Care.* 1993;15 (Suppl. 1):244-247.
30. King H, Rewers M. Diabetes in adults is now a Third World problem. *WHO Bull OMS*. 1991;69:644.
31. Stein JH, West KM, Robey JM, Tirador DF, McDonald GW. The high prevalence of abnormal glucose tolerance in the Cherokee Indians of North Carolina. *Arch Intern Med*. 1965;116:842-845.
32. Knowler WC, Saad MF, Pettitt DJ, Nelson RG, Bennett PH. Determinants of diabetes mellitus in the Pima Indians. *Diabetes Care* 1993;16(Suppl. 1):216-227.
33. Sievers ML, Nelson RG, Knowler WC, Bennett PH. Impact of NIDDM on mortality and causes of death in Pima Indians. *Diabetic Care*. 1992;15:1541-1549.
34. Sievers ML, Nelson RG, Bennett PH. Adverse mortality experience of a southwestern American Indian community: overall death rates and underlying causes of death in Pima Indians. *J Clin Epidemiol*. 1990;43: 1231-1242.
35. Brosseau JD, Eelkema RC, Crawford AC, Abe TA. Diabetes among the three affiliated tribes: correlation with degree of Indian inheritance. *Am J Public Health*. 1979;69:1277-1278.

Crow Agency Anticoagulation Service Initiated by Pharmacists

Daniel Struckman, RPh, currently Senior Pharmacist, Northern Cheyenne Service Unit, Lame Deer, Montana; formerly at the PHS Indian Hospital, Crow Agency, Montana.

Warfarin therapy to prevent blood clots can be dangerous because of the drug's extremely complex properties.[1] The dosage that prevents unwanted clots is only a fraction less than the dose that can cause potentially harmful or life-threatening bleeding. Many factors such as other medications, changes in diet, or concurrent health problems alone or in combination can influence a patient's response to warfarin. Dosage changes take 7-10 days to have their full effect. For these reasons, dosage is impossible to predict and must be carefully individualized. The consequences for the patient for mismanagement of therapy can range from minor bleeds and bruises, to thromboembolic events, to major cerebral vascular accident and death.

The Indian Health Service (IHS) hospital at Crow Agency, Montana, a 24-bed, acute care facility, serves the inpatient and outpatient needs of some 16,000 American Indians on the Crow and Northern Cheyenne Reservations. This paper describes how the pharmacy department at this facility established a pharmacist-managed anticoagulation service to help ensure the safety of patients for whom warfarin is prescribed

The medical and pharmacy staffs at the Crow Agency Service Unit had been concerned about the safe and effective use of warfarin and had previously sought to ensure the safety of anticoagulation therapy by conducting retrospective reviews of potential drug-drug interactions and by conducting medical staff education about the use of anticoagulant medications. Despite these interventions, one patient experienced a hematoma in his leg several weeks after his warfarin dose had been doubled; a greatly prolonged prothrombin time was found at the time of this occurrence. Another patient had had several episodes of bruising on his feet and ankles concurrently with excessively elevated prothrombin times. While neither patient required hospitalization, these cases demonstrated the need for close monitoring of warfarin therapy. In an effort to prevent further problems with warfarin therapy, the author visited a nearby Department of Veterans Affairs hospital and observed for two days the practices of a clinical pharmacist who ran a specialized anticoagulation clinic for nearly 200 patients.

Upon return to the service unit, all 12 patients on anticoagulants were identified using a computer search of prescription files. After reviewing each of these patient's health records, the pharmacists completed an anticoagulation therapy flow sheet* using data from the previous two to three months. The flow sheet included the following information: diagnosis indicating the need for anticoagulation therapy, the proposed duration of anticoagulation therapy, the desired anticoagulation range, dates of clinic visits, previous warfarin dosage, prothrombin test results, dosage changes, and a "remarks" field (used to write the percentage change in the dose and the

* The Anticoagulation Flow Sheet described in this paper has recently been revised to include updated guidelines for therapeutic ranges and space for additional patient data such as other diagnoses, other medications, allergies, and the date the anticoagulation therapy was initiated. This revised flow sheet is available from Du Pont Pharmaceuticals by calling toll-free: 800-268-6234.

number of days' therapy dispensed).

During the initial review of charts, several problems related to adequate documentation were identified. It was difficult to determine the original indication for warfarin therapy in two patients' records, and all but one of the health records had no therapeutic range defined. Because of this, therapeutic goals and the definition of over- or under-response to therapy were unclear, with management of therapy seeming to vary from physician to physician treating the same patient.

An inservice training session was conducted jointly by the medical and pharmacy staffs to address anticoagulation therapy issues including indications, contraindications, precautions, adverse reactions, dosage adjustments, and guidelines for patient follow up. A concurrent drug use evaluation (DUE) of warfarin was then initiated. Locally-developed, written standards of care, utilizing the following DUE criteria were adopted by the medical and pharmacy staffs at Crow Agency:

1. A written plan would be placed in each warfarin patient's record, including the reason for therapy; the proposed duration of therapy; and intensity of therapy, expressed as a therapeutic range of acceptable prothrombin time (PT) values.
2. No more than a 15 to 25 percent change in dosage would be made at one time, and such changes had to be followed up by checking the prothrombin time† within 7-10 days of making the change.
3. Prothrombin time results would be interpreted in light of non-drug factors, such as interactions with other medications, drug-food interactions, drug-disease interactions, and missed doses, and the provider would document these appropriately in the patient's medical record.
4. Appropriate quantities of warfarin would be dispensed at each visit. No more than six weeks' worth of medication would be dispensed to patients, and then only to those whose response to warfarin was quite stable.

Over time, the pharmacists became increasingly involved in helping manage anticoagulation therapy at the service unit. They maintained the flow sheets (kept in the pharmacy) by recording information on them after each visit to the primary care provider. Having the data organized in a consistent manner facilitated therapeutic interventions by the pharmacists, such as avoiding dispensing of drugs that might interact with warfarin. In addition, to save time for both the patient and the primary provider, those patients needing only laboratory tests reported directly to the pharmacy to pick up the necessary laboratory slips.

Ultimately, the pharmacists developed prescribing protocols that were essentially the same as the DUE criteria. The patients would come to the pharmacy and were interviewed about compliance, their general health, diet, other medications, and the presence of any untoward bleeding. To facilitate complete and consistent documentation, the pharmacists used a rubber stamp checklist, with all these items included, on the patient's medical record. Patients would receive a lab slip to get a prothrombin time and any other appropriate laboratory tests. At first, there was a high level of physician-pharmacist interaction. After some months had elapsed, the program evolved into one that allowed for more independent patient management by the pharmacists.

Pharmacists at Crow Agency continue to consult with physicians quite often, especially when caring for unstable patients or for those whose anticoagulation is maintained at a greater intensity. However, most of the pharmacists have been credentialed by the medical staff and now adjust warfarin dosages, according to the protocol, to keep the intensity of anticoagulation within the limits prescribed by physicians.

Part of the protocol requires that a monthly review of patient records be performed by the pharmacists to assure that the standards of quality for warfarin therapy are adhered to and that problems are identified and resolved. The results of this review are shared at monthly staff meetings.

Outcomes

Patients have expressed satisfaction with the care they receive from the pharmacists when they go to have their prothrombin time checked and have their warfarin supply replenished. They can be confident that the pharmacist and physician are close partners in managing their care. Patients are, however, given the option of visiting a physician instead of the pharmacist, and two of the patients do so. The pharmacy continues to monitor their therapies and to record their data on a profile.

Physicians too, have expressed appreciation for the methodical, consistent attention that the pharmacists pay to these patients. To assess how well pharmacists help manage the warfarin patients' therapies, a retrospective tally of prothrombin test results was performed; this method of evaluating warfarin anticoagulation clinics has been described previously.[2-3] Prothrombin test results for one year periods before and after the program began were compared to determine if there was any increase in the number of results that fell within the prescribed therapeutic limits. Forty-three percent of prothrombin test results

† In 1993, during the start of the period covered by this report, the anticoagulation laboratory test for warfarin therapy at Crow Agency was reported in terms of prothrombin time. More recently, the staff has adopted the international normalized ratio (INR) to measure the intensity of anticoagulation in a more standardized manner.

before the program began fell within the prescribed limits, while 58% of the results after the program was initiated fell in this range.

Another way one might assess the pharmacist-managed program is to compare the number of untoward events (e.g., bleeding) that resulted in hospitalization before and after the program was initiated. A chart review disclosed no hospitalizations during the one year period before the pharmacy program was initiated and only one instance in the one year period after the program was initiated, when a patient was hospitalized for a severe nosebleed (she was also suffering from an acute urinary tract infection and chronic anemia). This patient was being treated with warfarin to prevent clots from a mechanical heart valve, requiring a higher intensity of anticoagulation therapy. Her medical condition had been difficult to manage because of several other concurrent chronic illnesses and, as a result, she consistently had had very labile prothrombin times despite the fact her anticoagulation therapy was being managed in strict accordance with protocol. A review of the case did not disclose any deficiencies in the way her warfarin therapy was being managed. However, her hospitalization does underscore the potentially serious nature of warfarin therapy.

The incidence of lesser complications (e.g., self-limited nosebleeds or other bleeds or bruising that were not associated with an elevated PT or did not require hospitalization) was not assessed in this chart review. None of the patients receiving anticoagulation therapy, before or after the pharmacy-managed program was initiated, were found to have suffered from thromboembolic events.

Indian Health Service pharmacists traditionally have had an expanded role in clinics and hospitals. Standard 6 of the IHS Pharmacy Branch Standards of Practice states that pharmacists will manage therapy for selected patients in whom drugs are the primary method of treatment.[4] All of the pharmacists at Crow Agency have expressed pride and satisfaction in being able to contribute to the safety and effectiveness of warfarin therapy. The medical staff at Crow Agency has been supportive, and there has been a collegial sense of give-and-take with regard to managing the patients who take warfarin.

Acknowledgements

Special thanks to pharmacists James Carder, Donovan Sauter, Yvette Driver, Tabetha Zenisek, and Lisa Rose, the members of the pharmacy team who continue to help manage therapy. Also, thanks to Dr. Robert Byron and the other members of the medical staff at Crow Agency who have been supportive in the design and implementation of this program. Thanks to Albert Fisher at the Billings Area Office who helped with revising this paper.

References

1 Carter Barry L. Therapy of acute thromboembolism with heparin and warfarin. *Clinical Pharmacy*. Jul 1991;10:503-518.

2 Garabedian-Ruffalo S, Gary D, *et al*. Retrospective evaluation of a pharmacist-managed warfarin anticoagulation clinic. *Am J Hosp Pharm*. Feb 1985;42:304-308.

3 Ellis RF, Stephens MA, Sharp GB. Evaluation of a pharmacy-managed warfarin-monitoring service to coordinate inpatient and outpatient therapy. *Am J Hosp Pharm*. Feb 1992;49:387-392.

4 Indian Health Service Pharmacy Branch Standards of Practice. Rockville, MD: Indian Health Service; Dec 13, 1988:8.

Erratum

References numbered 4 through 7 were inadvertently omitted from the article entitled "Beliefs of Native American Patients About Diabetes" published in the June 1995 issue of *The IHS Primary Care Provider* (1995;20(6):80-82). They are as follows:

4 Given CW, Given BA, Gallin RS, Condon JW. Development of scales to measure the beliefs of diabetic patients. *Research in Nursing and Health*. 1990;6:127-141.

5 Cohen J. Statistical Power Analysis for the Behavioral Sciences. New York, NY: Academic Press; 1977.

6 SPSSx user's guide. 2nd ed. SPSS Inc, 1983.

7. Lieninger M. Transcultural Health Care Issues and Considerations: Health Care Dimensions. 3rd ed. Philadelphia, PA: FA Davis; 1975.

State-of-the-Art Education about HIV Disease

In a unique, multi-agency, public-private sector venture, Captain Abe Macher, MD, U.S. Public Health Service (USPHS), and Eric Goosby, MD, of the HIV Policy Office, Office of the Assistant Secretary for Health, collaborate with the Indian Health Service, the Health Resources and Services Administration, the National Institute for Allergy and Infectious Diseases (NIAID) at the National Institutes of Health, the Centers for Disease Control and Prevention, and the Voice of America to direct the international state-of-the-art HIV clinical conference call series.

During these live, interactive, audio teleconferences, primary care providers and educators have the extraordinary opportunity to discuss current HIV-related clinical issues with internationally renowned experts. Three-month pre-program needs assessments are conducted in preparation for each program as thousands of primary care providers are canvassed to determine which topics, and specific questions, will be addressed at each session. A final list of submitted questions, glossaries, articles, references, and clinical consultation referral telephone numbers are collated into an agenda, which is faxed to each participating clinical site and the expert panelists prior to each program. During the live program, submitted questions are answered by the expert panelists, the telephone lines are opened for follow up "live-on-the-air" questions. Post-program evaluations are completed following each session.

Participating primary care providers include allopathic and osteopathic physicians, nurses, physician assistants, clinical pharmacists, dentists, respiratory therapists, psychologists, counselors, case managers, social workers, other allied health care professionals, and educators. In all 50 states of the United States, the District of Columbia, Puerto Rico and the Virgin Islands, participating providers gather around speakerphones in conference rooms at their work sites; they simply dial a "1-800" toll free telephone number to join the clinical conference call. Participating sites include Indian Health Service clinics and hospitals; community and migrant health centers; public health clinics, private practice offices; visiting nurse and home care agencies; hospice care facilities; county/state/federal correctional institutions; community and academic hospitals; military clinics and hospitals of the Army/Navy/Air Force; Department of Veterans Affairs Medical Centers; schools of medicine/nursing/pharmacy; NIAID-sponsored community programs for clinical research on AIDS, NIAID-sponsored AIDS clinical trials units; the AIDS Treatment Information Service Reference Specialists of the USPHS; hemophilia centers; and the HIV Division of the American Medical Association in Chicago, among others. The program is simultaneously broadcast live worldwide through short wave radio and satellites by the Voice of America.

Participating agencies and organizations include the Food and Drug Administration; Health Care Financing Administration; Department of Defense; Department of Veterans Affairs; U.S. Information Agency; Federal Bureau of Prisons; National Institute of Corrections, U.S. Department of Justice; American Correctional Association; State Departments of Corrections; National Health Service Corps; Occupational Safety and Health Administration; National Hemophilia Foundation; American Academy of Physician Assistants; National Association of Community Health Centers; American Red Cross; American Lung Association; Association of State and Territorial Health Officials; San Francisco General Hospital; City and State Departments of Health; U.S. Agency for International Development; and the U.S. Department of State.

The program entitled "Tuberculosis: Clinical Management Issues" was heard by over one million persons worldwide, including over 10,000 participants at 710 clinical sites in the United States. The multidisciplinary panel of experts included Thomas Frieden, MD, of the Centers for Disease Control and Prevention; Sharon Hansen, PhD, at the Food and Drug Administration; Michael Iseman, MD, at National Jewish Hospital in Denver; German Maisonet, Jr., MD, at the Federal Bureau of Prisons; Lee Reichman, MD, at the National Tuberculosis Center; Gisela Schecter, MD, at San Francisco General Hospital; and Basil Vareldzis, MD, at the U.S. Agency for International Development. In addition to worldwide broadcast by the Voice of America, the program was also broadcast live by the Armed Forces Radio Network to military clinics and hospitals overseas.

The next program is entitled "Quantitative HIV Viral Load" and will be broadcast from 1:00 to 3:00 P.M. Eastern Time on September 28, 1995. Those who wish to obtain registration and needs assessment forms should fax their request to Dr. Macher at 301-443-1719. All registered sites will be faxed a toll free "800" telephone number and final agenda one week prior to the session. All primary care providers and educators at Indian Health Service and tribal health care facilities are encouraged to participate in this unique "on-site," toll free educational series.

References

1 Macher A, Goosby E, *et al*. The international state-of-the-art HIV clinical conference call series. In: *Proceedings of the Ninth International Conference on AIDS*. Berlin, Germany. Abstract PO-D14-3815. June 1993;p.853.

2 Macher A, Goosby E, *et al*. Educating primary care providers about HIV disease: multidisciplinary interactive mechanisms. *Public Health Reports*. May-Jun 1994; 109(3):305-310.

3 Macher E, Goosby E, *et al*. Telephone information services from USPHS. *AJN*. Sep 1994;94:12.

NATIVE AMERICAN MEDICAL LITERATURE ①

The following is an updated MEDLINE *search on Native American medical literature. At the end of each cited article, you will find a unique identifying (UI) number. For those of you who may wish to obtain a copy of a specific article, this can be facilitated by giving the librarian nearest you the UI number as well as the complete citation.*

If your facility lacks a library or librarian, try calling your nearest university library, the nearest Veterans Administration Hospital, the nearest state medical association, or the National Library of Medicine (1-800-272-4787) to obtain information on how to access journal literature within your region. Bear in mind that most local library networks function on the basis of reciprocity and, if you do not have a library at your facility, you may be charged for services provided.

Feather J, Irvine J. Challenge of home care in remote communities. *Arctic Med Res*. 1991;Suppl:26-9. 95091905

Ward JA. Developing community mental health services for indigenous people of northern Ontario. *Arctic Med Res*. 1991;Suppl:256-60. 95091904

Carey M. The continuum of mental health services available to Indians and Inuit living in the Alberta Region. *Arctic Med Res*. 1991;Suppl:254-5. 95091903

Armstrong HA. The development and evolution of mental health services in the Sioux Lookout zone over a nineteen year period. *Arctic Med Res*. 1991;Suppl:249-53. 95091902

Esperon-Rayson G, Gofton C, Angiyou M, Deyell JA. The role of the interpreter in the provision of specialized medical care. *Arctic Med Res*. 1991;Suppl:233-4. 95091896

Adelson N. Being alive well: the praxis of Cree health. *Arctic Med Res*. 1991;Suppl:230-2. 95091895

Garro LC. Ways of talking about illness in a Manitoba Anishinaabe (Ojibway) community. *Arctic Med Res*. 1991;Suppl:226-9. 95091894

Wheatley MA. Developing an integrated traditional/clinical health system in the Yukon. *Arctic Med Res*. 1991;Suppl:217-20. 95091890

Garro LC. Consultations with Anishinaabe (Ojibway) healers in a Manitoba community. *Arctic Med Res*. 1991;Suppl:213-6. 95091889

Keeper C. Barriers to health careers in British Columbia: problems and solutions. *Arctic Med Res*. 1991;Suppl:201-4. 95091884

Berger T. Keynote address. Circumpolar Health 90. *Arctic Med Res*. 1991;Suppl:2-7. 95091883

Prince CS. Research on Indian reserves—an Indian perspective. *Arctic Med Res*. 1991;Suppl:185-7. 95091877

Kaufert JM, O'Neil JD, Koolage WW. The cultural and political context of informed consent for Native Canadians. *Arctic Med Res*. 1991;Suppl:181-4. 95091876

Lynch GI. Movement toward professional excellence—Medical Services Branch Indian Health. *Arctic Med Res*. 1991;Suppl:173-6. 95091874

Caldera DL. Community Health Aide Program: health care for rural Alaska Natives by rural Alaska Natives. *Arctic Med Res*. 1991;Suppl:166-9. 95091872

Quick R, Bashshur R. Three perspectives on community health aides: surveys of health aides, consumers and providers in western Alaska. *Arctic Med Res*. 1991;Suppl:161-5. 95091871

Caldera D, Daniels S, Ashenfelter W. The role of the community health aide in rural Alaska. *Arctic Med Res*. 1991;Suppl:157-60. 95091870

Thomlinson E, Gregory D, Larsen J. A northern Bachelor of Nursing Program: one solution to problems in health care provision. *Arctic Med Res*. 1991;Suppl:145-8. 95091866

Dickson G, Irvine J, Hemmelgarn B. Joint initiative on health science programs for Native students. *Arctic Med Res*. 1991;Suppl:141-2. 95091864

Roberts E. Community development: how can education and training have an impact? *Arctic Med Res*. 1991;Suppl:138-40. 95091862

Stephens MC. The special premedical studies program—review of ten years of experience. *Arctic Med Res*. 1991;Suppl:134-7. 95091861

Bearskin S, Dumont C. The Cree Board of Health and Social Services of James Bay: the first twelve years: 1978-1990. *Arctic Med Res*. 1991;Suppl:123-5. 95091857

DeGross DP. A brief discussion of the development of Native owned health provider agencies in Alaska within the context of anticipated health and systems issues. *Arctic Med Res*. 1991;Suppl:101-5. 95091850

Circumpolar Health 90. Proceedings of the 8th International Congress on Circumpolar Health. Whitehorse, Yukon, May 20-25, 1990. *Arctic Med Res*. 1991;Suppl:1-786. 95091849

Tague RG. Maternal mortality or prolonged growth: age at death and pelvic size in three prehistoric Amerindian populations. *Am J Phys Anthropol*. 1994 Sep;95(1):27-40. 95091247

McCabe M. Patient Self-Determination Act: a Native American (Navajo) perspective. *Camb Q Healthc Ethics*. 1994 Summer;3(3):419-21. 95086727

Rickards O, Tartaglia M, Martinez-Labarga C, De Stefano GF. Genetic relationships among the Native American populations. *Anthropol Anz*. 1994 Sep;52(3):193-213. 95085240

McMillan I. Reserve findings [news]. *Nurs Times*. 1994 Nov 16-22;90(46):18.

Xu W, Beutler E. The characterization of gene mutations for human glucose phosphate isomerase deficiency associated with chronic hemolytic anemia. *J Clin Invest*. 1994 Dec;94(6):2326-9. 95081417

Mercier B, Raguenes O, Estivill X, *et al*. Complete detection of mutations in cystic fibrosis patients of Native American origin. *Hum Genet*. 1994 Dec;94(6):629-32. 95080771

Ravussin E, Valencia ME, Esparza J, Bennett PH, Schulz LO. Effects of a traditional lifestyle on obesity in Pima Indians. *Diabetes Care*. 1994 Sep;17(9):1067-74. 95079928

Shlossman M. Diabetes mellitus and periodontal disease—a current perspective. REVIEW ARTICLE: 70 REFS. *Compendium*. 1994 Aug;25(8):1018, 1020-4 passim; quiz 1032. 95079481

Silver S. Lessons from child of water. *Am Indian Alsk Native Ment Health Res*. 1994;6(1):4-17. 95078325

Barse H. American Indian veterans and families. *Am Indian Alsk Native Ment Health Res*. 1994;6(1):39-47. 95078324

Johnson D, LaDue R. A cultural and community process. *Am Indian Alsk Native Ment Health Res*. 1994;6(1):34-8. 95078323

Holm T. The national survey of Indian Vietnam veterans. *Am Indian Alsk Native Ment Health Res*. 1994;6(1):18-28. 95078321

Holm T. Warriors all. *Am Indian Alsk Native Ment Health Res*. 1994;6(1):1-3. 95078320

Manson SM. Indian and Native communities realize the extent of military service touches the lives of this special population [editorial]. *Am Indian Alsk Native Ment Health Res*. 1994;6(1):V. 95078319

Kohn LA, Vannier MW, Marsh JL, Cheverud JM. Effect of premature sagittal suture closure on craniofacial morphology in a prehistoric male Hopi. *Cleft Palate Craniofac J*. 1994 Sep;31(5):385-96. 95078240

Jacobson SF. Native American health. REVIEW ARTICLE: 60 REFS. *Annu Rev Nurs Res*. 1994;12:193-213. 95077987

Nobmann ED, Mamleeva FY, Klachkova EV. A comparion of the diets of Siberian Chukotka and Alaska Native adults and recommendations for improved nutrition, a survey of selected previous studies. *Arctic Med Res*. 1994 Jul;53(3):123-9. 95077644

Curet MJ, Rosendale DE, Congilosi S. Mirizzi syndrome in a Native American population. *Am J Surg*. 1994 Dec;168(6):616-21. 95068649

Stuart CA, Smith MM, Gilkison CR, Shaheb S, Stahn RM. Acanthosis Nigricans among Native Americans: an indicator of high diabetes risk. *Am J Public Health*. 1994 Nov;84(11):1839-42. 95068572

Fontvieille AM, Rising R, Spraul M, Larson DE, Ravussin E. Relationship between sleep stages and metabolic rate in humans. *Am J Physiol*. 1994 Nov;267(5 Pt 1):E732-7. 95068348

Lock M. Interrogating the Human Diversity Genome Project. [editorial] *Soc Sci Med*. 1994 Sep;39(5):603-6. 95064153

Hisnanick JJ. Comparative analysis of violent deaths in American Indians and Alaska Natives. *Soc Biol*. 1994 Spring-Summer;41(1-2):96-109. 95064137

Pearson D, Cheadle A, Wagner E, Tonsberg R, Psaty BM. Differences in sociodemographic, health status, and lifestyle characteristics among American Indians by telephone coverage. *Prev Med*. 1994 Jul;23(4):461-4. 95062056

Newcomer W, Rivin B, Reid R, *et al*. Immunogenicity,

safety and tolerability of varying doses and regimens of inactivated hepatitis A virus vaccine in Navajo children. *Pediatr Infect Dis J*. 1994 Jul;13(7):640-2. 95061067

Bell R. Prominence of women in Navajo healing beliefs and values. *Nurs Health Care*. 1994 May;15(5):232-40. 95060327

Templin DW, Boyer GS, Lanier AP, *et al*. Rheumatoid arthritis in Tlingit Indians: clinical characterization and HLA associations. *J Rheumatol*. 1994 Jul;21(7):1238-44. 95055460

Jacobsson LT, Pillemer SR. What can we learn about rheumatic diseases by studying Pima Indians? [editorial] *J Rheumatol*. 1994 Jul;21(7):1179-82. 95055449

Ong CK, Bernard HU, Villa LL. Identification of genomic sequences of three novel human papillomavirus sequences in cervical smears of Amazonian Indians. *J Infect Dis*. 1994 Nov;170(5):1086-8. 95052822

Valdini AF, Valdini A, Chick K. Body mass index is increasing at reservation high schools. [letter] *J Am Diet Assoc*. 1994 Nov;94(11):1253. 95052209

Lowe LP, Tranel D, Wallace RB, Welty TK. Type II diabetes and cognitive function. A population-based study of Native Americans. *Diabetes Care*. 1994 Aug;17(8):891-6. 95044724

Roberson NL. Clinical trial participation. Viewpoints from racial/ethnic groups. *Cancer*. 1994 Nov 1;74(9 Suppl):2687-91. 95042185

Kavanagh KH. Learning from the Lakota. *Nurs Spectr (Wash D C)* 1994 Oct 3;4(20):8. 95039931

Dillon M, Lam T, Beardy N, Gordon J, Dooley J, Harris S. Maternal serum screening in the Sioux Lookout Zone. Complicated test for an unspecified need. *Can Fam Physician*. 1994 Oct;40:1766-71. 95037821

Fine A, Cox D, Bouw M. Higher incidence of peritonitis in native Canadians on continuous ambulatory peritoneal dialysis. *Perit Dial Int*. 1994;14(3):227-30. 95035317

Michael JM, Michael MA. Health status of the Australian aboriginal people and the Native Americans: a summary comparison. *Asia Pac J Public Health*. 1994;7(2):132-6. 95033584

Huttlinger KW, Tanner D. The Peyote way: implications for Culture Care theory. *J Transcult Nurs*. 1994 Winter;5(2):5-11. 95032962

Duffy SA, Bonino K, Gallup L, Pontseele R. Community baby shower as a transcultural nursing intervention. *J Transcult Nurs*. 1994 Winter;5(2):38-41. 95032958

Jacobsson LT, Knowler WC, Pillemer S, *et al*. A cross-sectional and longitudinal comparison of the Rome criteria for active rheumatoid arthritis (equivalent to the American College of Rheumatology 1958 criteria) and the American College of Rheumatology 1987 criteria for rheumatoid arthritis. *Arthritis Rheum*. 1994 Oct;37(10):1479-86. 95032219

Levy MT, Jacober SJ, Sowers JR. Hypertensive disorders of pregnancy in southwestern Navajo Indians. *Arch Intern Med*. 1994 Oct 10;154(19):2181-3. 95031535

Johnson BL, Lybarger J. ATSDR's response to Archives' editorial: a deliberate smokescreen. [comment] Comment on: *Arch Environ Health*. 1994 May-Jun;49(3):154-5. *Arch Environ Health*. 1994 Sep-Oct;49(5):312-3; discussion 314-5. 95031245

Hong CS, Xiao J, Casey AC, Bush B, Fitzgerald EF, Hwang SA. Mono-ortho- and non-ortho-substituted polychlorinated biphenyls in human milk from Mohawk and control women: effects of maternal factors and previous lactation. *Arch Environ Contam Toxicol*. 1994 Oct;27(3):431-7. 95031244

Westermeyer J, Neider J. Substance disorder among 100 American Indian versus 200 other patients. *Alcohol Clin Exp Res*. 1994 Jun;18(3):692-4. 95030270

Roberts JD, Poffenroth LA, Roos LL, Bebchuk JD, Carter AO. Monitoring childhood immunizations: a Canadian approach [see comments]. Comment in: *Am J Public Health*. 1994 Oct;84(10):1567-8. *Am J Public Health*. 1994 Oct;84(10):1666-8. 95030077

Nutting PA, Calonge BN, Iverson DC, Green LA. The danger of applying uniform clinical policies across populations: the case of breast cancer in American Indians. *Am J Public Health*. 1994 Oct;84(10):1631-6. 95030067

Dean M, Stephens JC, Winkler C, *et al*. Polymorphic admixture typing in human ethnic populations. *Am J Hum Genet*. 1994 Oct;55(4):788-808. 95029379

Schulz LO, Schoeller DA. A compilation of total daily energy expenditures and body weights in healthy adults. *Am J Clin Nutr*. 1994 Nov;60(5):676-81. 95029068

Hatton DC. Health perceptions among older urban American Indians. *West J Nurs Res*. 1994 Aug;16(4):392-403. 95027893

Change of Address or Request for New Subscription Form

Name _____

Title _____

Social Security No. _____

New Address _____

City/State/Zip _____

Old Address _____

(Please include old label if possible)

Service Unit (if applicable) _____

IHS Employee ❑ **Tribal** ❑ **Other** ❑

THE IHS PRIMARY CARE PROVIDER

The Provider is published monthly by the Indian Health Service Clinical Support Center (CSC).

Telephone: (602) 640-2140 Fax: (602) 640-2138

Wesley J. Picciotti, MPA ..... *Director, CSC*

Wilma L. Morgan, MSN, FNP,
E. Y. Hooper, MD, MPH,
John F. Saari, MD ..... *Editors*

M. Kitty Rogers, MS, RN-C,
Thomas J. Ambrose, RPh ..... *Contributing Editors*

Opinions expressed in articles are those of the authors and do not necessarily reflect those of the Indian Health Service or the Editors.

Circulation: *The Provider* (ISSN 1063-4398) is distributed to more than 6000 health care providers working for IHS and tribal health programs, to medical and nursing schools throughout the country, and to health professionals working with or interested in American Indian and Alaska Native health care. If you would like to receive *The Provider,* free of charge, send your name, address, professional title, and place of employment to the address listed below.

Publication of articles: Manuscripts, comments, and letters to the editor are welcome. Items submitted for publication should be no longer than 3000 words in length, typed, double-spaced, and conform to manuscript standards. IBM-compatible word processor files are preferred.

Authors should submit at least one hard copy with each electronic copy. Manuscripts may be received via the IHS Banyan electronic mail system. References should be included. All manuscripts are subject to editorial and peer review. Responsibility for obtaining permission from appropriate Tribal authorities/Area Publications Committees to publish manuscripts rests with the author. For those who would like some guidance with manuscripts, a packet entitled "Information for Authors" is available by contacting the CSC at the address below.

Dept. of Health and Human Services
Public Health Service
Indian Health Service Clinical Support Center
1616 East Indian School Road, Suite 375
Phoenix, Arizona 85016

BULK RATE
Postage and Fees Paid
U.S. Dept. of Health & Human Services

Permit No. G-290

ADDRESS CORRECTION REQUESTED

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300